CLAIMS

What is claimed:

5   1.   A method for embedding watermark, comprising:

(a)   evaluating   in   a   predetermined   manner   a
characteristic value for a signal within a frame obtained by
segmenting the signal to be watermarked in a predetermined
time period;

10   (b)   determining   a   quantized   value   most   closely
approximated to said characteristic value by comparing said
characteristic value with said quantized value within a set
among a plurality of sets including one or more quantized
value respectively, said set corresponding to a value of
15   pattern information embedded into the frame;

(c) evaluating an intensity of insertion used in order
to   modify   the   signal   within   the   frame   so   that   the
characteristic value is the same . as the quantized value
determined in the step (b); and

20   d)   modifying   the   signal   within   said   frame   based   on
said intensity of insertion.

2.   The   method   according   to   claim 1,   further   comprises
filtering the signal through a predetermined range of
25   frequency before said step (a), wherein said characteristic
value for said filtered signal is evaluated in said step (a).

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3.   The method according to claim 1, further comprises detecting a silent part within the signal, wherein said step (a) to (d) are performed for a frame including the signal excepting said silent part.

4.   The method according to claim 1, wherein said pattern information includes an error detecting code or an error correcting code.

5.   The method according to claim 1, wherein said pattern information includes a synchronizing signal.

6.   The method according to claim 1, wherein said pattern information consists of one bit for each frame.

7.   The method according to claim 1, wherein said pattern information consists of a plurality of bits for each frame.

8.   The method according to claim 7, further comprises filtering the signal through a plurality of ranges of frequency with a respectively different range of a band before said step (a), wherein said plurality of bits is inserted respectively into each of signals filtered through said plurality of ranges of frequency.

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9.   The method according to claim 1, wherein said characteristic value is evaluated as follows:

$$F = \frac{S_A - S_B}{S_A + S_B}$$

$$S_A = \sum_{t=i-1}^{i-1/2} s^2(t) \ , \ S_B = \sum_{t=i-1/2}^{i} s^2(t)$$

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(Herein, s (t) means a signal within a frame to be watermarked, i-1, i-1/2 and i respectively mean notations indicating a starting point of range A, an ending point of A (or a starting point of range B), and an ending point of

10   range B when a frame is segmented into range A and range B, and F means a characteristic value).

10.   The method according to claim 1, wherein said characteristic value is evaluated as follows:

$$F = \frac{S_A - S_B}{S_A + S_B}$$

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$$S_A = \sum_{t=i-1}^{i-1/2} |s(t)| \ , S_B = \sum_{t=i-1/2}^{i} |s(t)|$$

(Herein, s (t) means a signal within a frame to be watermarked, i-1, i-1/2, and i respectively mean notations indicating a starting point of range A, an ending point of A

20   (or a starting point of range B), and an ending point of range B when a frame is segmented into range A and range B,

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and F means a characteristic value).

11.   The method according to claim 1, wherein said step (d) is performed as follows:

$$\text{RANGE A}: s'(t) = s(t) + g \cdot s(t)$$
$$\text{RANGE B}: s'(t) = s(t) - g \cdot s(t)$$

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(Herein, range A and range B mean notations indicating each range when a frame is segmented into two ranges,

s(t) is the signal within a frame to be watermarked,

g is an intensity of insertion, and

10   s'(t) is a signal obtained by modifying the signal s(t) in said step (d) so that said characteristic value is the same as said quantized value)

12.   A method for detecting a watermark from a signal into

15   which the watermark is embedded according to the method described in claim 1, comprising:

    (e) evaluating a characteristic value for the signal within a frame obtained by segmenting the signal in a predetermined time period in accordance with the same manner

20   in said step (a);

    (f) determining a quantized value most closely approximated to said characteristic value by comparing said characteristic value evaluated in said step (e) with each quantized value within a plurality of sets of said quantized

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values used for a quantization of said characteristic value in embedding said watermark; and

(g) extracting a value corresponding to the set of quantized values involving said quantized value determined in said step (f), as a pattern information embedded into said frame.

13. The method according to claim 12, further comprises filtering the signal through a range the same as a range of a frequency for filtering in embedding said watermark before said step (e), wherein said characteristic value for said filtered signal is evaluated in said step (e).

14. The method according to claim 12, further comprises detecting a silent part within the signal, wherein said step (e) to (g) are performed for a frame including the signal excepting said silent signal.

15. The method according to claim 12, further comprises performing operation for an error detecting or an error correcting for a bit string of said pattern information extracted in a sequence from each frame.

16. The method according to claim 12, further comprises detecting a synchronizing signal from said extracted pattern

information.

17.   The method according to claim 12, wherein said pattern information inserted into said one frame consists of a plurality of bits inserted respectively into a plurality of ranges of frequency with a respectively different range of a band,

and said method further comprises filtering the signal through said plurality of ranges of frequency before said step (e),

wherein said step (e) to (g) are performed for each filtered signal.

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